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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/654,501	09/01/2000	Yuji Takahashi	PM 273792	7004

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EXAMINER

BAUMEISTER, BRADLEY W

ART UNIT PAPER NUMBER

2815

DATE MAILED: 10/16/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.
09/654,501

Applicant(s)
Takahashi et al.

Examiner
B. William Baumeister

Art Unit
2815



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Aug 8, 2002
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-36 is/are pending in the application.
- 4a) Of the above, claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-36 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 8/8/02 is: a) ☒ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some* c) ☐ None of:
- ☒ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- *See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____ 6) ☐ Other:

Art Unit: 2815

DETAILED ACTION

Priority

1. Acknowledgment is made of applicant's claim for foreign priority based on an applications filed in Japan on 9/2/1999 and 12/17/1999.

Specification

2. The disclosure is objected to because of the following informalities: Applicants have amended the specification to correct mistakes relating to the particular color of light that various phosphors emit. This includes an amendment to a paragraph on page 14 of the specification wherein Applicants now states that YVO₄:Ce emits green light and that YVO₄:Ce emits red light.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 12-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 12 recites the limitation "said fluorescent material" in line 6. As independent claim 11 has been amended to recite both "a first fluorescent material" and "a second fluorescent

Art Unit: 2815

material,” there is insufficient antecedent basis for this limitation in claim 12, rendering it unclear whether “said fluorescent material” refers to the first fluorescent material of claim 11, the second fluorescent material, or both materials.

Claim Rejections - 35 USC § 103

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. Claims 1-3, 8, 10, 23 and 24 are rejected under 35 U.S.C. 103(a) as obvious over Soules ‘254 in view of Ishibashi et al. ‘203.

a. Soules discloses LEDs or laser diodes that emit primary, blue light in the range of 420-470 nm (col. 3, lines 57-60). The LED is covered with a phosphor-containing polymer layer 15 and clear polymer lens 16 (e.g., FIG. 2), and both of these materials may be composed of the same material such as silicone (col. 3, lines 50-56). Various phosphors are employed so that a portion of the blue light emitted from the semiconductor device is absorbed and the phosphors emit secondary, green and red light respectively, so that the primary and secondary colors are blended to produce various colors including white light.

b. Regarding claim 8, since polymer layer 15 contains the phosphors and polymer layer 16 is composed of the same material as layer 15, but does not possess phosphors, the structure reads on a polymer layer having a step-graded phosphor profile.

Art Unit: 2815

c. Regarding claims 23 and 24, Soules teaches that the red phosphor may be composed of $(\text{Ca}, \text{Sr})\text{S}:\text{Eu}$ where $0 \leq \text{Sr} \leq 1$; or $\text{CaS}:\text{Eu}$ (e.g., col. 2, lines 1-25).

d. Claim 1 has been amended to set forth that the primary light source includes a GaN LED and includes a reflector closer to the substrate than is the light emitting layer. Soules does not disclose the composition of the LED/LD that may be used.

e. Ishibashi discloses GaN LED having an active layer that emits blue light and discloses a DBR that is interposed between the substrate and the active layer for reflecting light and increasing light transmission through the top surface. See e.g., FIG 8 which is discussed as being composed of a GaN-based composition and FIG 7 which is discussed in terms of II-VI materials, but which also may be composed of III-Vs (e.g., GaN-based) (cols. 7-8). It would have been obvious to one of ordinary skill in the art at the time of the invention to compose the LED or LD of Soules of GaN as taught by Ishibashi since GaN LEDs are conventionally used to emit blue light, and it would have been obvious to provide it with a bottom reflector for the purpose of increasing the light emission efficiency as also taught by Ishibashi.

7. Claims 4-7, 9, 35 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soules-Ishibashi as applied to the claims above, and further in view of Butterworth et al. '507.

a. Soules discloses the elements as set forth above including the red phosphor $\text{CaS}:\text{Eu}$, and it also discloses that the phosphor layer 15 is covered with a bullet-shaped sealing member 16 which are both composed of the same material, as set forth in claims 5-7 and 9, but

Art Unit: 2815

does not appear to mention the presence of conventional structures such as a lead frame having a cup-shaped portion. Butterworth discloses UV/blue LEDs disposed in a cup-shaped reflector/lead frame and which are overcoated with any of various bullet-shaped, fluorescent-dye-containing epoxies 240. One phosphor listed is the green-emitting ZnS:Cu,Al,Au (col. 3, line 54). Butterworth also states that depending on the implementation, some unabsorbed original blue light may also pass through the lens (col. 2, lines 64, 65) and states that multiple dyes can be employed to produce white light (i.e., also use a red dye) (col. 3, line 5). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to dispose the device taught by Soules-Ishibashi on a cup-shaped portion of a lead frame as taught by Butterworth for the purpose of providing a receptacle for supporting the chip and the polymer and/or for increasing the light emission efficiency by reflecting laterally-directed light upward.

8. Insofar as definite, claims 11-13, 18, 20, 35 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soules-Ishibashi as applied to the claims above, and further in view of Hampden-Smith et al. '123. Soules discloses various phosphors that may be used for green-light photoluminescence, but does not appear to disclose any of the specific phosphors recited in the Markush group of claim 11 (ZnS:Eu, YVO₄:Ce and Y₂O₂S:Ce) or claim 35.

a. Hampden-Smith '123 teaches various sulfur-containing phosphors that can be used in an array of applications including photoluminescence (col. 35, lines 28-33). These phosphors include ZnS:Eu (paragraph spanning cols. 35-36); ZnS:Cu (Table 1, col. 37) and ZnS:Cu, Au, Al

Art Unit: 2815

(col. 36, lines 8-15) for various hues of blue/green and CaS:Eu for red light (col. 36, line 19). It would have been obvious to one of ordinary skill in the art at the time of the invention to employ within the light emitter of Soules-Ishibashi, any of the phosphors specifically mentioned in Hampden-Smith for any of various reasons such as: (1) to obtain the particular hue associated with the specific phosphor or (2) for business reasons such as relating to the cost and availability of a particular phosphor.

9. Claims 14-17 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soules--Ishibashi--Hampden-Smith as applied to claims 11-13, 18, 20, 35 and 36 above, and further in view of Butterworth et al. '507. As was explained previously hereinabove, regardless of whether any of the base references mentions the presence of a lead frame having a cup-shaped portion, Butterworth discloses UV/blue LEDs disposed in a cup-shaped reflector/lead frame and which are overcoated with any of various bullet-shaped, fluorescent-dye-containing epoxies 240. One phosphor listed is the green-emitting ZnS:Cu,Al,Au (col. 3, line 54). Butterworth also states that depending on the implementation, some unabsorbed original blue light may also pass through the lens (col. 2, lines 64, 65) and states that multiple dyes can be employed to produce white light (i.e., also use a red dye) (col. 3, line 5). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to dispose the device taught by Soules--Ishibashi--Hampden-Smith on a cup-shaped portion of a lead frame as taught by Butterworth for the purpose of

Art Unit: 2815

providing a receptacle for supporting the chip and the polymer and/or for increasing the light emission efficiency by reflecting laterally-directed light upward.

10. Claims 21, 25-27, 32 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soules-Ishibashi as applied to claims 1-3, 8, 10, 23 and 24 above, and further in view of Thompson et al. '489. Soules teaches blue-emitting semiconductor LEDs overcoated with downconverter phosphors as explained above, but does not disclose the device used in combination with an additional red LED.

a. Thompson teaches a full-color LED assembly comprising two LEDs and a photoluminescent downconverter phosphor disposed for re-emission of longer wavelength light in response to light that is emitted from only one of the two LEDs. The phosphor may either emit green or red light. The LED that is not in communication with the downconverter phosphor may emit red light. Through the use of the combination of an LED with a phosphor and an LED without a phosphor, different colors of light can be selectively obtained subsequent to manufacturing.

b. It would have been obvious to one of ordinary skill in the art at the time of the invention to have employed a blue LED overcoated with a green-emitting phosphor as taught by Soules-Ishibashi as explained above in combination with a red LED instead of an additional red phosphor for the purpose of obtaining white light emission while simultaneously enabling increased post-manufacturing color control beyond that enabled by a blue LED overcoated with

Art Unit: 2815

green and red phosphors at least for any of the purposes of (1) providing an assembly that can selectively emit various desired colors (e.g., red, blue and green, or white); (2) enabling later color readjustment in the event that the amount of blue or green light degrades or otherwise changes over time; or (3) providing an assembly wherein the red color is not subject to color alteration attributable to phosphor degradation. Further, it would have been obvious to use a red-emitting LED for the LED which does not produce secondary phosphor re-emission, since Soules and Thompson teach the use of down-converting phosphors (i.e., phosphors wherein higher-energy, shorter wavelength colors are absorbed and re-emitted as lower-energy, longer wavelength colors), and red is the lowest energy, longest wavelength color of blue, green and red, thereby ensuring that regardless of the assembly's configuration or the two LEDs' relative disposition, any spurious light from this second LED will not cause any significant secondary re-emission in the phosphor.

11. Claims 22, 28-31 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soules-Ishibashi-Thompson as applied to the claims 21, 25-27, 32 and 34 above, and further in view of Butterworth et al. '507. As was explained previously, regardless of whether any of the base references mentions the presence of a lead frame having a cup-shaped portion, Butterworth discloses UV/blue LEDs disposed in a cup-shaped reflector/lead frame and which are overcoated with any of various bullet-shaped, fluorescent-dye-containing epoxies 240. One phosphor listed is the green-emitting ZnS:Cu,Al,Au (col. 3, line 54), as set forth in claim 22. Butterworth also

Art Unit: 2815

states that depending on the implementation, some unabsorbed original blue light may also pass through the lens (col. 2, lines 64, 65). It would have been obvious to one of ordinary skill in the art at the time of the invention to dispose the device taught by Soules--Ishibashi--Thompson on a cup-shaped portion of a lead frame as taught by Butterworth for the purpose of providing a receptacle for supporting the chip and the polymer and/or for increasing the light emission efficiency by reflecting laterally-directed light upward.

Response to Arguments

12. Applicant's arguments with respect to the claims have been considered but are either moot in view of the new ground(s) of rejection or are not persuasive.

a. Applicant has argued that the rejections of claims 23, 24, 36 and 37 were improper so that any new grounds of rejection would not be necessitated by Applicants' amendment and must be non-final. This is not persuasive for the following reasons:

i. Claims 23 and 24 were rejected in light of the 112-2nd rejection under the interpretation that Applicant intended to recite that the structure included a red phosphor *instead of* a red LED (see paragraph 8f of the last Office Action). Further, Thompson was employed in the rejection of the parent claim 21 for the teachings of red LEDs--not for the teachings of red phosphors. As such, Thompson was not required for the rejection of these claims. Moreover, Applicant has confirmed that this interpretation of the claims was correct by amending claim 23 so

Art Unit: 2815

as to be independent and to thereby overcome the 112-2nd rejection by omitting the recitation of the red LED. As such, the rejection was proper.

ii. Claim 36 was rejected under an interpretation that CaS:Eu was intended *instead of* one of the phosphors set forth in the Markush group of independent claim 11 (see paragraph 8c of the previous Office Action). This position was based on, necessitated by, and the result of the confusion caused by Applicants' improper disclosure in the specification that all of the phosphors of the claim 11 Markush group emit red light. As such, Applicants' correction of the specification after the Office Action has necessitated any change in the interpretation of the claim and any changes to the rejections resulting therefrom. Further, Applicant was or should have been sufficiently apprised of the Examiner's position regarding the obviousness of combining conventional red and green phosphors to produce white light from a reading of other portions of the Office Action (see e.g., see e.g., paragraph 11a of the last Office Action).

iii. Claim 37 has been canceled, so the issue is moot.

b. The other arguments with respect to the claims are moot in light of the new grounds of rejection.

Conclusion

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

Art Unit: 2815

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

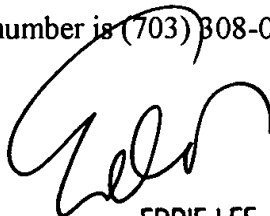
INFORMATION ON HOW TO CONTACT THE USPTO

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to the examiner, **B. William Baumeister**, at **(703) 306-9165**. The examiner can normally be reached Monday through Friday, 8:30 a.m. to 5:00 p.m. If the Examiner is not available, the Examiner's supervisor, Mr. Eddie Lee, can be reached at (703) 308-1690. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

B. William Baumeister

Patent Examiner, Art Unit 2815

October 12, 2002


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